

Title of Project

- Feasibility of a Touch screen Computer based breastfeeding educational support program

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Structured Abstract

Purpose: The pilot study was aimed to evaluate usefulness and effectiveness of an interactive, touch screen, bilingual breast-feeding educational program in improving breastfeeding knowledge, self-efficacy and intent to breastfeed to enhance partial/exclusive breastfeeding practices.

Scope: Breast-feeding is an effective way to promote infants and mothers health. Healthy People 2020 aim to increase exclusive breastfeeding to 44% at 3 months and 24% at 6 months. Current breast-feeding rates fall short of these goals.

Methods: A two-group repeated measures quasi-experimental design was utilized. 46 prenatal Hispanic rural women, during their last six weeks of pregnancy, aged 15 years and above were enrolled and randomly assigned to either intervention (bi-lingual Computer based Breast-feeding Educational Support program) or attention control (bilingual breast-feeding printed educational material) groups at the Regional West Medical Center in Scottsbluff. Variable information gathered included socio-demographics, health literacy, breast-feeding knowledge, breast-feeding self-efficacy and intent to breastfeed. Partial and exclusive breastfeeding information was also gathered. Baseline and follow up assessments was done at day3, day7, week2, week6, months 3 and 6 in both control and intervention groups. Two focus groups were conducted to examine factors affecting the decision to continue breastfeeding among Hispanic rural women. Heuristic and usability evaluation of the system was also conducted.

Results: There was an improvement in breastfeeding knowledge, self-efficacy and individuals' intent to breastfeed especially among those study participants in the intervention group. The study participants continued to partially breastfeed up to month six of the follow up period.

Keywords: Breastfeeding, Hispanic, Self-efficacy, Knowledge, Computers

PURPOSE

A bilingual touch screen Computer based Breast-feeding Educational Support program to promote breast-feeding among Hispanic rural women living in Scottsbluff area of rural Nebraska was developed. To our knowledge, this is the first ever study to deliver breastfeeding education through use of a touch screen computer based program in a rural setting. The pilot study aimed to deliver interactive, touch screen, bilingual breast-feeding educational program using varied multimedia formats (such as combination of audio, text, images and video). The proposed computer based program was built using behavioral, learning and humanistic theories. These were the specific aims:

- **Specific Aim1:** To examine factors affecting the decision to continue breastfeeding among Hispanic rural women using focus groups.
- **Specific Aim2:** To design and develop interactive touch screen, bilingual, computer-based Breast-feeding Educational support program for Hispanic rural women.
- **Specific Aim3:** To pilot test the acceptance of computer-based Breast-feeding Educational Support program and explore its effect on breastfeeding knowledge, breastfeeding self-efficacy and partial breastfeeding among Hispanic rural women.

SCOPE

Breast-feeding is an effective way to promote infants and mothers health. Currently, 75% of babies born in the U.S. are initially breastfed, but rates fall to 43% at 6 months and 22% by 12 months¹. The American Academy of Pediatrics recommends that infants be fed only breast milk for the first 6 months of life, but only 13% of babies in the U.S meet this breast-feeding standard¹. Healthy People 2020 aims to increase rates to 82% ever breastfed, 61% at 6 months, and 34% at year one¹. Exclusive breastfeeding goals are set for 44% at 3 months and 24% at 6 months¹. Additionally, no state in the United States met the *Healthy People 2010* objectives for 75% of infants being exclusively breastfed immediately postpartum and 50% by 6 months². Current breast-feeding rates fall short of these goals. Many mothers wean early or initiate complementary feeding of their children before it is recommended and advantages of breast-feeding and breast milk are not realized².

METHODS

A two-group repeated measures quasi-experimental design was used to explore the impact of using a Computer based Breast-feeding Educational Support program to promote breastfeeding in rural Hispanic women through improvement of their breast-feeding knowledge and breast-feeding self-efficacy. 46 prenatal Hispanic rural women, anytime during their last six weeks of

pregnancy, aged 15 years and above were enrolled and randomly assigned to either intervention (bi-lingual Computer based Breast-feeding Educational Support program) or attention control (bilingual breast-feeding printed educational material) groups at the Regional West Medical Center (RWMC) in Scottsbluff. Variable information gathered included socio-demographics, health literacy, breast-feeding knowledge, breast-feeding self-efficacy and intent to breastfeed. Follow up assessments was done on day3, day7, week2, week6, month3 and month6 in both the groups. Primary outcomes measured included Breastfeeding knowledge, self-efficacy and intent to breastfeed using Breastfeeding Attrition Prediction Tool (BAPT). Information was also gathered on partial (combined formula and breast milk feeding) and exclusive breastfeeding. Exploratory analysis will also be performed to determine proportion of subjects who performed exclusive breast-feeding in both the groups at six months. The study protocol was approved by the University of Nebraska Medical Center Institutional Review Board (IRB protocol #430-12-EP) and City University of New York Institutional Review Board (IRB protocol # 642980-1).

Variables Assessed: Information on the following variables was gathered.

- **Socio-demographics** information gathered included age of study participants, education, family income, marital status, employment status and smoking history. **Maternal History** and **Health literacy** was also assessed.
- **Breastfeeding Knowledge:** Knowledge of breastfeeding was assessed using 30 item breastfeeding knowledge questionnaires (BKQ) ³⁻⁵.
- **Breastfeeding Self-Efficacy:** Information regarding the study participants' confidence in breastfeeding was gathered using 14 item Breastfeeding Self-efficacy Scale Short Form (BSES-SF) questionnaire⁶. The response options were from 1=not confident to 5=always confident, with scores ranging from 1-5⁶. The minimum and maximum scores for the BSES-SF scale was 14 and 70 respectively, with scores less than 50 indicating a higher risk for breastfeeding cessation⁶.
- **Breastfeeding Attrition Prediction Tool (BAPT):** Factors influencing the likelihood of breastfeeding discontinuation were gathered using the 35-item Breastfeeding Attrition Prediction Tool (BAPT) questionnaire^{7, 8}. The BAPT consists of 4 subscales including: positive breastfeeding sentiments (PBS), negative breastfeeding sentiments (NBS), social and professional support (SPS), and perceived behavioral control (PBC)^{7, 8}. These subscales assess the participant's perception of the general positive opinions regarding breastfeeding (PBS), general negative opinions about breastfeeding (NBS), normative

beliefs on breastfeeding (SPS), and the level of confidence in one's ability to breastfeed (PBC)^{7, 8}. The BAPT scale had a minimum value of 0 and a maximum value of 38, with scores above 20 indicating an above average intention to breastfeed^{7, 8}.

Procedure

1. **Focus groups:** Two focus group sessions were conducted using a convenience sample of 12 Hispanic women, aged 19 years or older, and were enrolled from the Regional West Medical Center, Scottsbluff, a rural setting in Nebraska, during October 2012⁹. Each of the sessions lasted for about one to two hours. The questionnaires used were made available in both English and Spanish language, and a certified Spanish translator was present to assist participants. The sessions were also audio-recorded and a \$50 gift card was given to participants as an incentive.
2. **Heuristic Assessment:** Three usability raters were involved in the evaluation of an interactive bi-lingual breastfeeding educational support program in May 2013¹⁰. Two evaluators individually reviewed the user interface of the breastfeeding support program and generated a list of heuristic violations. A severity scale ranging from 0 (no usability problem) to 4 (usability catastrophe) was applied to all violations. A third rater, an expert in the area of evaluation of health technologies, reviewed and resolved any disagreements for any differences that occurred to identify the potential heuristic violations.
3. **Usability Assessment:** Ten Hispanic rural women constituting a convenience sample were enrolled at the Regional West Medical Center (RWMC), Scottsbluff during May 2013¹¹. Flyers were distributed at RWMC to circulate this information. Study subjects were given an orientation to the prototype, and then assigned six specific pre-defined tasks to complete by interacting with the prototype. Usability scores were computed for the participants using System Usability Scale (SUS)

INTERVENTION

The study participants in the intervention group received tailored breast-feeding education compared to the attention control that received bilingual printed breast-feeding educational materials¹². Breast-feeding educational messages were presented in varied multimedia formats using a combination of text, images, and animations to account for the health literacy levels of the subjects¹². Appropriate feedback was given in the form of reinforced educational messages and encouragement and motivational prompts for those using the computer based program. Educational session in both the groups lasted for 30 minutes¹².

Snapshots of the Breastfeeding Educational Program

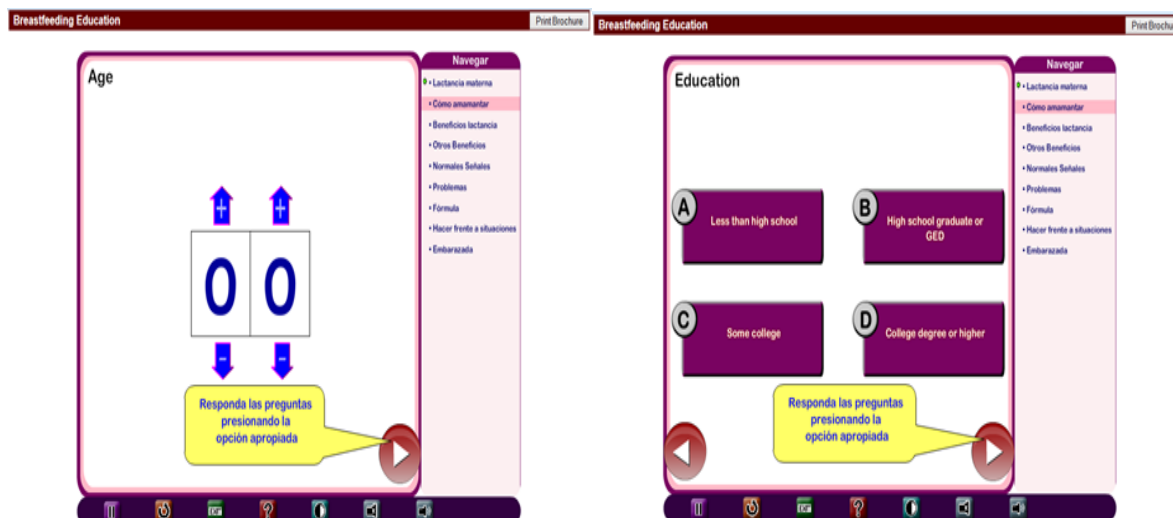


Figure 1a and 1b. Screening components

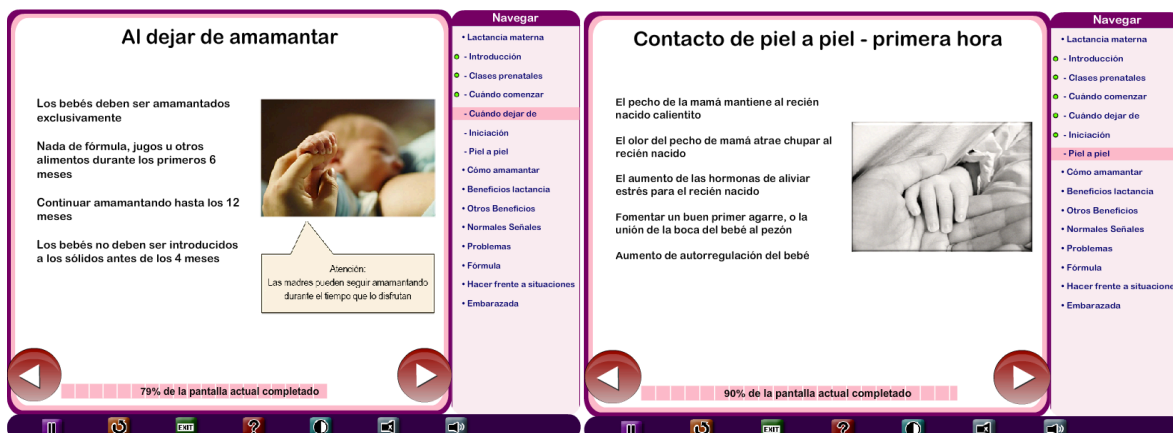


Figure 1. Bi-lingual Breastfeeding educational program

RESULTS

Focus group findings

More than half of the focus group participants (N=12) were between 19 and 24 years of age, were married (75%, n=9), unemployed (58%, n=7) and had obtained 12 or more years of education (58%, n=7)⁹. The study participants had adequate health literacy⁹. 42% of the study participants had breastfed their children for up to 6 months⁹. More than half of the women had not previously taken prenatal breastfeeding classes⁹. Results of the focus groups helped us understand the challenges of breastfeeding, timing of breastfeeding, benefits of breastfeeding

as perceived by the study participants so that relevant educational modules can be developed⁹.

Challenges of Breastfeeding: The most common challenges identified were; (a) Sore nipples, (b) severe engorgement, (c) plugged ducts and (d) family interference⁹. **Benefits of Breastfeeding:** The most common benefits of Breastfeeding perceived by the study participants included child's health and that breastfeeding is a cheaper option than the formula feeding⁹. **Decision to Breastfeed:** Factors influencing their decision to breastfeed included: perceived health benefits for the baby, and family influence⁹. The results also showed that the main problems throughout the first weeks of breastfeeding included latching on and milk production. Results of these findings have been published in Rural and Remote Health Journal⁹ (PMID: 25170852) <http://www.ncbi.nlm.nih.gov/pubmed/25170852>

Heuristics Evaluation

A total of 271 screens were evaluated and 97 heuristics violations were observed¹⁰. The average severity index of overall heuristic violations was 2. Majority of the violations had minor usability issues (73%, $n = 71$)¹⁰. No catastrophic issues were encountered for the interface. The suggestions provided give an insight into the various possible changes that can be incorporated to the proposed interactive, bi-lingual touchscreen-enabled breastfeeding educational support program for Hispanic women living in rural settings¹⁰. The findings of this study have been published in the *Journal of Innovation in Health Informatics*¹⁰ (PMID: 26245240) <http://www.ncbi.nlm.nih.gov/pubmed/26245240>

Usability Evaluation

A convenience sample of 10 Hispanic rural women at the Regional West Medical Center (RWMC), Scottsbluff was enrolled during May 2013¹¹. The average age of the study participants was 28 years, the majority of them had 12 or more years of education and more than half of them had breastfed less than 6 months¹¹. No assistance was needed to complete any of the tasks. One hundred percent of the study participants agreed that the educational content enhanced with visual images was sufficient to meet their informational needs related to breastfeeding¹¹. The various functions of the program including the play/pause button, audio, and images were extremely beneficial. The help function was very useful and one of the participants felt that "help section is informative to let me know how to proceed to the next section"¹¹. The labeling of buttons, highlighting keywords, videos, able to make distinctions between two screens, and the ability to self-select the choice of medium to acquire breastfeeding related information (audio or text) could be additional features that can be added to the existing program. There were two study participants that also felt that a progress monitor and a summary report at the end of the program would be useful to help them show how far

they have to complete the tasks and how much more they still have to go¹¹. Overall, the interactive, touch screen computer-based breastfeeding program had high acceptance. The findings of this study have been published in the *JMIR research protocols*¹¹ (PMID: 24200498) <http://www.ncbi.nlm.nih.gov/pubmed/24200498>

Socio-demographic Characteristics of the participants

The study participants had an average age of 25 years, were mostly single (52%), unemployed (54%), with 10 to 12 years of schooling (54%)¹². More than half of them never smoked (61%)¹². The majority of the study participants had adequate health literacy¹². Less than half of the study participants (33%), had previously breastfed for less than 6 months, and this was considerably lower than the national average of 49.4%¹². Study participants had an average of one child (SD=1), with an average of 2 previous pregnancies (SD=2)¹². Less than half of them had engaged in prior prenatal classes (48%, n=22), or had breastfed their children for up to 3 months (24%, n=11), Majority did not intend to take any prenatal classes (57%, n=26)¹². The results of the socio-demographic analysis have also been published in *Journal of Community Health*¹² (PMID: 25868495) <http://www.ncbi.nlm.nih.gov/pubmed/25868495>

Breastfeeding Knowledge

Baseline and follow up Breastfeeding knowledge scores were compared between the control and the intervention groups. The average breastfeeding knowledge score of all the study participants at baseline was 22.9 (max score=30) There was no significant difference in the breastfeeding knowledge scores between the control and the intervention groups at baseline (p=0.47). Study participants within the intervention group showed a significant positive improvement in their average change in breastfeeding knowledge scores at different follow up time points (p<0.05) compared to those in the control group that showed significant positive improvement in their breastfeeding knowledge scores at month3 (p<0.05). Significant difference in the breastfeeding knowledge scores between the control (Mean=23.2; SD=3.7) and intervention (Mean=25.3; SD=2.6) groups were seen only at week6 of the follow up (p=0.03).

Breastfeeding Self-efficacy

Baseline and follow up breastfeeding self-efficacy scores were compared between the control and the intervention groups. The average breastfeeding self-efficacy score of all the study participants at baseline was 54.6 (max score=70). There was no significant difference in the average change in breastfeeding self-efficacy scores between the control and the intervention

groups. Study participants in the control group had a gradual decline in the breastfeeding self-efficacy scores from week 6 onwards as compared to those in the intervention group that showed an improvement in the breastfeeding self-efficacy scores. Significant improvement in the average change in breastfeeding self-efficacy scores was seen among the study participants in the intervention and control group at day3, day7 and week2. There was a gradual decline in the self-efficacy scores at month3 and month6 in the control group. Results of our analysis also showed an increase in percentage of participants with high breastfeeding self-efficacy scores in the intervention group at month 6 as compared to baseline (87% vs. 65%), compared to the control group that showed decrease in the percentage of individuals with high breastfeeding self-efficacy scores at month 6 as compared to baseline (70% vs. 78%).

Intent to Breastfeed using BAPT scores

The average intent to breastfeed BAPT scores of all the study participants at baseline was 28.1 (max score=38). No significant difference was seen in the average BAPT scores among the individuals in intervention and control group ($p>0.05$). There was an improvement in the average change in intent to breastfeed scores (BAPT) among all the study participants at all the time points. Study participants in the intervention group showed significant improvement in the intent to breastfeed scores at day3 ($p=0.004$), week2 ($p=0.04$) and month3 ($p=0.04$) compared to their baseline levels. However, participants in the control group showed significant improvement only at day3 ($p=0.02$), day7 ($p=0.05$) and week2 ($p=0.007$) compared to their baseline. No other significant improvements in the average change in the BAPT scores were seen within the intervention and control groups at any other time intervals. There was no significant difference in the average change in BAPT scores between the control and the intervention groups at any follow up time points.

BAPT Sub-scale analysis

- A. Positive Breastfeeding Sentiment score:** Positive breastfeeding sentiment BAPT scores assess the perception of general positive opinions regarding breastfeeding (maximum score =11) Both the control and intervention groups experienced a slight increase in positive breastfeeding sentiments between baseline and week 6, followed by a decline at month 3, and an increase at month 6.
- B. Negative Breastfeeding Sentiment score:** Negative breastfeeding sentiment BAPT scores assess the perception of negative sentiments regarding breastfeeding (maximum score=7). Results showed that individuals in the control group had a higher perception of the negative implications of breastfeeding at all the time points, and this difference was significant at baseline (Control: -3.2 vs. Intervention: -4.3; $p= 0.02$) and during day 3

(Control: -3.7 vs. Intervention: -4.8; $p= 0.03$). No significant differences were seen in negative breastfeeding sentiments between the control and intervention groups at the other time points.

C. Social and Professional Support BAPT score: Social and professional support assesses normative beliefs on breastfeeding (maximum score=8). Higher social and professional support BAPT scores means the women's social support groups are more in favor of breastfeeding as opposed to formula feeding, while lower Social and professional support BAPT scores means the support groups are less in favor of breastfeeding. No significant changes were seen in the average social and professional scores among individuals in the intervention and control groups at any of the time points.

D. Perceived Behavioral Control BAPT score: Perceived behavioral control assesses self-confidence of the individuals in their ability to breastfeed, with a maximum score of 12. Higher perceived behavioral control means individuals have more confidence in their skills to breastfeed, and vice versa. Results showed a consistent increase in the perceived behavioral control BAPT scores in the intervention group as compared to those in the control group. However, there were no significant differences in the intervention and control groups at any of the time points.

At month 6, the intervention group was more likely to respond positively to the individual Perceived Behavioral Control BAPT items especially in perceptions involving: determination to breastfeed (Intervention: 91% vs. Control: 61%; $p=0.04$), and needing help to breastfeed (Intervention: 70% vs. Control: 39%; $p=0.02$). No significant differences were seen in other perceptions on the PBC scale between control and intervention groups.

Qualitative analysis of the intent to breastfeed (BAPT) scale showed that at baseline, less than half of the study participants made the decision to breastfeed their babies before they became pregnant (46%, $n=21$). Others made the decision to breastfeed their babies during their first trimester (35%, $n=16$), second trimester (13%, $n=13$) and third trimester (7%, $n=3$).

All the study participants intended to breastfeed as their primary method of infant feeding at baseline, and day 3 (100%, $n=46$). This trend gradually changed from day 7 onwards, as some participants decided to formula feed as their primary mode of infant feeding, especially at week 6 (breastfeed: 76% vs formula feed; 22%), month 3 (breastfeed: 52% vs formula feed: 48%) and at month 6 (breastfeed: 43% vs formula feed: 54%).

Breastfeeding Practices

Results of this report revealed that all study participants continued partial breastfeeding from day 3 until month 6 (100%, n=46). The percentage of study participants in the intervention group who significantly breastfed for at least 10 times at week 2 was significantly higher than those in the control group (39% vs. 13%; p=0.04).

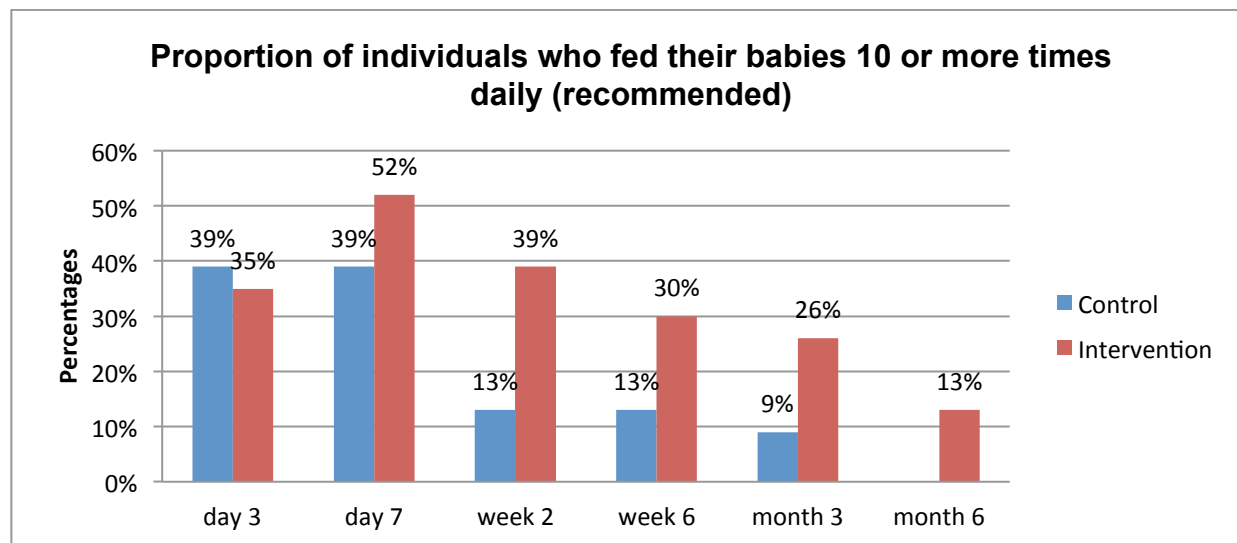


Figure2. Proportion of individuals who breastfed babies 10 times or more different time points.

Breastfeeding Discomforts

The most common breastfeeding discomforts reported by the study participants were sore nipples (24%, n=52) and severe engorgement (13%, n=28). Breast infections were mostly reported by the control group, except for one occurrence in the intervention group at month 6. Other breastfeeding discomforts specified included: insufficient milk production (11%, n=5), thrush (2%, n=1), and poor latching (2%, n=1), and were more commonly reported by the control group.

Breast milk Supplementation

- A. **Supplementation with Water:** No significant differences were observed between the control and intervention groups in breast milk supplementation with water at all the time points.
- B. **Formula supplements:** Participants in both the control and intervention groups supplemented their breast milk at day 3 (48%, n=11). Breast milk supplementation gradually increased in the control group from day 7(26%, n=6) to week 2(48%, n=11), but remained constant in the intervention group at these time points (52%, n=12). Breast

milk supplementation decreased from week 6 to month 6 among the participants in both control (43% to 22%) and intervention (26% to 13%) groups. The study showed participants continuing to partially breastfeed up to month 6.

- C. **Amount of formula supplements:** None of the participants fed their babies with more than 3 ounces of supplement at day 3. Only 7% of the participants fed their babies with more than 3 ounces of supplement at day 7 (n=3). However, this gradually increased at month 3 (52%, n=24), and finally declined at month 6 (41%, n=19). Participants in the intervention group were more likely to feed their babies with 3 ounces or less of breastfeeding supplements at all the follow up time points except at week 2.
- D. **Type of formula supplements:** The most common type of supplement used by the study participants both in the control and the intervention group was 'Enfamil'. Other less commonly used formula supplements included: Similac, Nutramigen, Neocate, Parents choice, and Elecare.
- E. **Introducing solid food to babies:** None of the participants introduced solid food to their babies until month 3. At month 6, 78% of the study participants in the control group initiated solid food compared to 74% of the study participants in the intervention group.

Breastfeeding support groups

The most commonly reported support groups that aided the participants with continuing breastfeeding included their partners, self-support, and mothers. Self-support was more frequently reported among the intervention group as compared to the control group. The intervention group was more likely to obtain support from their mothers at most of the time points; however there were no significant differences.

Reasons for discontinuing breastfeeding

Insufficient milk production and poor latching of babies were some of the common reasons for discontinued breastfeeding.

Program Assessment

The study participants in the intervention group showed high program acceptance.

Discussion

Breastfeeding benefits have been widely studied, and the myriad of factors influencing breastfeeding rates and discontinuation are continuously being explored among diverse population groups. The results of our study revealed an overall significant improvement in the average change in breastfeeding knowledge and Intention to breastfeed (BAPT) scores among all study participants (n=46), especially among those in the intervention group (n=23) between the baseline and the individual follow-up assessments. However, the average change in breastfeeding self-efficacy significantly improved among study participants from baseline to week 6 ($p<0.05$), but declined at month 3 ($p=0.46$), and month 6 ($p=0.54$). This suggests the need for additional interventions to sustain self-efficacy improvement at these time points.

Significant differences in the breastfeeding knowledge scores among the study participants in the control and intervention groups were seen only at week 6 ($p=0.03$). This reflects a possible implication of week 6 as a critical time point of intervention to sustain breastfeeding knowledge. The control group also experienced a decline in self-efficacy scores at month 3 ($p=0.56$) and month 6 ($p=0.45$), from baseline. These critical time points correspond with early discontinuation of breastfeeding in prior literature, since self-efficacy has been constantly associated with breastfeeding intention^{12, 13}. Further analysis showed an increase in the percentage of individuals having high self-efficacy (score >50) and high BAPT (score >20) at month 6 compared to baseline, among both intervention and control groups, reflecting the earlier correlation established between self-efficacy and BAPT scores in our preliminary baseline report ($R=0.75$; $p<0.001$), which was more evident in the intervention group¹⁴. No significant differences were observed in the self-efficacy and BAPT scores between the intervention and control groups at all follow up time points compared to baseline ($p>0.05$). Study participants in the control group had a significantly higher perception of the negative implications of breastfeeding at day 3 ($p=0.03$) indicating lower intent to breastfeed.

Difficulty in returning to work (Intervention; 35% vs. Control; 52%; $p=0.04$), not getting enough rest (Intervention; 4% vs. Control; 30%; $p=0.03$), and limited flexibility (Intervention; 4% vs. Control; 13%; $p=0.03$), were significant negative breastfeeding sentiments reported by study participants in the control group. This reflects the need for additional intervention modules that can address these challenges. The intervention group showed improvement regarding perceived behavioral control elements such as determination to breastfeed (Intervention: 91%

vs. Control: 61%; $p=0.04$), and their ability to breastfeed without assistance (Intervention: 70% vs. Control: 39%; $p=0.02$).

Our study results are consistent with prior similar research reporting improvements in self-efficacy and intention to breastfeed, through employing the use of technology enabled breastfeeding interventions^{14, 15}. One of these studies utilized a computer animated female character (displayed on a computer screen) to provide customized breastfeeding messages based on the subject's name, baby's sex and type of delivery¹⁴. Tailored dialogues between the computer agent and study subject were generated based on information provided by the subject, previous conversations and the current discourse. Controls were assigned to usual care and obtained regular breastfeeding information from the hospital. Study participants were enrolled prior to delivery and follow-up assessments were conducted at 2 time points including: the day of delivery and day of hospital discharge. The intervention group reported a significantly higher intention to breastfeed ($p=0.049$), and higher self-efficacy, though not significant ($p=0.35$), compared to the control group¹⁴. Results of our study are similar to a prior study that showed an improvement in the breastfeeding self-efficacy scores at week 4 using a bi-lingual breastfeeding education workbook¹⁵. In this intervention, women in the intervention group received a breastfeeding self-efficacy workbook in their third trimester, while the control group was able to access the regular in-hospital support services as needed.¹⁵ Follow-up assessments were conducted at 4 time points including: before hospital discharge, at 1 month, 4 weeks and 12 weeks postpartum¹⁵.

There were several limitations of our study. First, the computer based bi-lingual breastfeeding educational program was primarily focused on Hispanic population living in rural settings. Further the results of the intervention showed improvement in the breastfeeding knowledge, self-efficacy and intent to breastfeed, however, were not significant at all the time points reflecting a need to have a larger sample size that can facilitate detection of change in these outcomes. Further there is a need to explore the role of specific interventions at week6 and month3 onwards.

Conclusion

Hispanic women living in rural settings showed improvement in breastfeeding knowledge, self-efficacy and intent to breastfeed using the computer based bi-lingual educational program. Results showed week6 and month3 to be the critical time points of intervention so that women

continue to breastfeed. Our study showed that the use of computer based bi-lingual breastfeeding educational program is feasible among Hispanic rural population, and has the potential to improve breastfeeding practices among women.

LIST OF PUBLICATIONS AND PRODUCTS

• Journal Publications

1. Joshi A, Trout KE, Aguirre T, et al. Exploration of factors influencing initiation and continuation of breastfeeding among Hispanic women living in rural settings: a multi-methods study. *Rural Remote Health* 2014 (2955). PMID: 25170852
2. Joshi A, Trout KE, Aguirre T, et al. An Interactive, Bilingual Touch Screen Program to Promote Breastfeeding among Hispanic Rural Women: Usability Study. *JMIR Research Protocols* 2013; 2(2). PMID: 26245240
3. Joshi A, Perin DMP, Amadi C, et al. Evaluating the usability of an interactive, bi-lingual, touchscreen-enabled breastfeeding educational program: application of Nielson's heuristics. *J Innovation Health Inform* 2015; 22(2), 265-274. PMID: 26245240
4. Joshi A, Trout KE, Aguirre T, et al. Comparison of Socio-Demographic Characteristics of a Computer Based Breastfeeding Educational Intervention Among Rural Hispanic Women. *J Community Health* 2015; 1-9. PMID: 25868495

Conference Poster Presentation

1. Wilhelm S, Aguirre T, Koehler A et al. Feasibility of a Bilingual, Interactive Computer-Based Breastfeeding Support Program for Rural Hispanic Women. AWHONN National Convention; June 13-17, 2015; Long Beach, CA.
2. Ashish J, Sue W, Trina A, et al. Characteristics of Hispanic rural women enrolled in an Interactive Computer based intervention to promote Breastfeeding practices. Poster Presentation at American Public Health Association; 2015 October 31–November 4; Chicago, IL.

Manuscripts under review

1. Ashish J, Chioma A, Jane M, et al. Evaluation of a Computer-based bilingual Breastfeeding educational program on Breastfeeding knowledge, Self-efficacy and intent to Breastfeed among rural Hispanic women. Submitted on October 9 2015 to **International Journal of Medical Informatics 2015**

2. Trina A, Ann K, Ashish J et al. Recruitment and Retention Challenges and Successes. Submitted to **Journal of Immigrant and Minority Health 2015**

MANUSCRIPT UNDER PREPARATION

1. Factors influencing Breastfeeding practices among rural Hispanic women: a quasi-experimental study.

- **PRODUCTS**

1. **Computer based Bi-lingual Breastfeeding Educational Program:** An Internet and Standalone Computer based bi-lingual Breastfeeding educational program has been developed. The modules of the finalized breastfeeding educational content were made available both in Spanish and English so that the study participant can use either language to navigate through the program. The entire finalized breastfeeding educational content will be broken down into a series of modules, each module into sub-modules and each sub-module into a series of educational messages. The computer-based program will have the ability to deliver breastfeeding education in varied learning styles such as text-only, audio and text, or text, audio, and images to account for health literacy of the individuals.
2. **Bi-lingual Breastfeeding Educational Program Booklet:** The breast-feeding educational content was broken down into series of modules, each module into sub-modules and each sub-module into a series of educational messages. The modules of the finalized breastfeeding educational content were made available both in Spanish and English so that the study participant can use either language to navigate through the program. The modules included: (a) Basics of breastfeeding (b) How to breastfeed (c) Benefits of breastfeeding to mother and child (d) Normal feeding signs (e) Problems during breastfeeding (f) Formula feeding (g) Coping with breastfeeding (h) Ability to get pregnant while breastfeeding.

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References

1. Maternal, infant and child health, objectives new to healthy people 2020 MICH HP 2020-12, MICH HP 2020-26-28. US Department of Health and Human Services: Developing Healthy People 2020. <https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health/objectives>. Accessed October 11, 2015
2. Centers for Disease Control and Prevention. Breastfeeding report card: United States 2010. <http://www.cdc.gov/breastfeeding/pdf/breastfeedingreportcard2010.pdf>. Accessed October 11, 2015.
3. Wambach KA, Aaronson L, Breedlove G, et al. A randomized controlled trial of breastfeeding support and education for adolescent mothers. West J Nurs Res 2011; 33 (4):486-505. PMID: 20876551
4. Cusson RM. Attitudes toward breast-feeding among female high-school students. Pediatr Nurs 1985; 11:189-191. PMID: 3846876
5. Hill PD. Effects of education on breastfeeding success. Matern Child Nurs J 1989; 16:145-156. PMID:3682950
6. Dennis CL. The breastfeeding self-efficacy scale: psychometric assessment of the short form. J Obstet Gynecol Neonatal Nurs 2003; 32(6): 734-744. PMID: 14649593
7. Fishbein M and Ajzen I. Predicting and changing behavior: The reasoned action approach. New York: Psychology Press; 2010
8. Gill SL, Reifsnider E, Lucke JF et al. Predicting Breast-feeding Attrition: Adapting the Breast-feeding Attrition Prediction Tool. J Perinat Neonatal Nurs 2007; 21(3):216-224. PMID: 17700098
9. Joshi A, Trout KE, Aguirre T, et al. Exploration of factors influencing initiation and continuation of breastfeeding among Hispanic women living in rural settings: a multi-methods study. Rural Remote Health 2014 (2955). PMID: 25170852

10. Joshi A, Perin DMP, Amadi C, et al. Evaluating the usability of an interactive, bi-lingual, touchscreen-enabled breastfeeding educational program: application of Nielson's heuristics. *J Innovation Health Inform* 2015; 22(2):265-274. PMID: 26245240

11. Joshi A, Trout KE, Aguirre T, et al. An Interactive, Bilingual Touch Screen Program to Promote Breastfeeding among Hispanic Rural Women: Usability Study. *JMIR Research Protocols* 2013; 2(2). PMID: 26245240

12. Joshi A, Trout KE, Aguirre T, et al. Comparison of Socio-Demographic Characteristics of a Computer Based Breastfeeding Educational Intervention Among Rural Hispanic Women. *J Community Health* 2015; 1-9. PMID: 25868495

13. Stuebe AM and Bonuck K. What predicts intent to breastfeed exclusively? Breastfeeding knowledge, attitudes, and beliefs in a diverse urban population. *Breastfeed Med* 2011; 6(6): 413-420. PMID: 21342016

14. Edwards RA, Bickmore T, Jenkins L, et al. Use of an interactive computer agent to support breastfeeding. *Matern Child Health J* 2013; 17(10):1961-1968. PMID: 23329167

15. Otsuka K, Taguri M, Dennis CL, et al. Effectiveness of a breastfeeding self-efficacy intervention: do hospital practices make a difference?. *Matern Child Health J* 2014; 18(1): 296-306. PMID: 23592322